

REMARKS / ARGUMENTS

I. General Remarks

Please consider the application in view of the following remarks. Applicants thank the Examiner for his careful consideration of the application.

Applicants hereby request continued examination of this application, in accordance with 37 C.F.R. § 1.114. Applicants respectfully request consideration of the claims in light of the amendments presented in the previously-filed Response to Final Office Action Mailed February 9, 2006 (filed April 7, 2006) (hereinafter “the April 7, 2006 Response”), and reproduced herein, and in light of the remarks contained herein. The remarks and arguments submitted in the April 7, 2006 Response are incorporated by reference into this Response.

The Advisory Action states that the amendments presented in the April 7, 2006 Response were not entered. (*See* Advisory Action at ¶ 7.) Those amendments have been reproduced herein for the Examiner’s convenience, and Applicants respectfully request entry of those amendments at this time.

II. Disposition of Claims

Claims 1-3, 5-18, and 60-62 are pending in this application. Claims 4, 18, and 22 were cancelled previously. Claims 19-59 were cancelled previously in response to a restriction requirement.

In this Response, claims 1, 3, 5, 7, 9, 12, 13, 17, and 60-62 have been amended. These amendments are supported by the specification as filed.

Claims 1-3, 6-18, and 62 stand rejected under 35 U.S.C. § 112. Claims 1-3, 5-16, 18, and 60-62 stand rejected under 35 U.S.C. § 102(b). Claim 17 stands rejected under 35 U.S.C. § 103(a).

III. Rejections of Claims

A. Rejections of Claims Under 35 U.S.C. § 112

Claims 1-3, 6-18, and 62 stand rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention. (*See* Final Office Action at ¶ 2.) With respect to these rejections, the Final Office Action states that “[t]he limitations of a particle size greater than 300 microns is not supported by the specification and claims as originally filed and

therefore constitute new matter.” *Id.* In response to Applicants’ remarks regarding these rejections in their previous response, the Final Office Action states:

Applicant [argues] that the specification has sufficient support for the limitations of a particle size greater than 300 microns. Applicant argues that to satisfy the written description requirement, a patent specification must describe the claimed invention in sufficient detail that one skilled in the art can reasonably conclude that the inventor has possession of the claimed invention. Applicant’s arguments are unpersuasive since it seems that applicant is arguing enablement and the rejection of the claims is based on a new matter rejection. Applicant also argues that since the instant specification teaches a particle size in the range of from about 400 mesh to about 8 mesh, the limitations of an average particle size greater than 300 microns is supported by the specification. There is no recitation or suggestion in the original specification of the limitations of a particle size greater than 300 microns. Additionally, a particle size of greater than 300 microns could be outside the range of 400 mesh to about 8 mesh. A particle size of greater than 300 microns does not include the lower limit of 400 mesh, as exemplified in applicant’s embodiment. The particle size of greater than 300 microns can include particle sizes that are greater than 8 mesh and therefore either limit of the range, including numbers between the range of 400 mesh to about 8 mesh would be excluded from applicant’s claimed limitations of greater than 300 micron.

Additionally, [if] applicant is relying on the range of 400 mesh to about 8 mesh to support the particle size of greater than 300 microns, the range raises issues of nonenablement since greater than 300 microns includes values outside of the range of 400 mesh to about 8 mesh.

Id. at ¶ 11 (emphasis added). The Advisory Action maintains these rejections in view of the non-entry of the amendment in the April 7, 2006 Response. (Advisory Action at Continuation to 11.) Applicants respectfully disagree with these rejections.

In order to properly reject a claim under § 112, first paragraph, “[t]he examiner has the initial burden of presenting evidence or reasoning to explain why persons skilled in the art would not recognize in the original disclosure a description of the invention defined by the claims.” MANUAL OF PATENT EXAMINING PROCEDURE § 2163(II)(A)(3)(b) (2005). Merely arguing lack of explicit “recitation or suggestion” in the disclosure, as the Final Office Action states above, is not sufficient to satisfy this burden. *See In re Wertheim*, 541 F.2d 257, 265

(CCPA 1976) (“The PTO has done nothing more than argue lack of literal support, which is not enough.”).

Rather, the determination of whether a claim limitation is sufficiently supported in the specification as filed (*i.e.*, whether the narrowing of a numerical range limitation constitutes the addition of new matter) “must take into account which ranges one skilled in the art would consider inherently supported by the discussion in the original disclosure.” MANUAL OF PATENT EXAMINING PROCEDURE § 2163.05 (2005) (discussing *In re Wertheim*, 541 F.2d 257, where a disclosed range of “25%-60%” range did not support a new limitation of “at least 35%,” but it did support a new limitation of “between 35% and 60%”); *see id.* at § 706.03(o) (discussing new matter rejections, and referring to *In re Wertheim* and MPEP § 2163.05 for determining whether addition of specific numerical ranges after a broader disclosure constitutes new matter). Applicants’ specification as filed contains at least the following discussion of particle sizes:

The degradable particles generally should have a particle size that is suitable for use in jetting tools that may be used in the methods of the present invention. In an exemplary embodiment, the degradable particles should have an average particle size in the range of from about 400 mesh to about 8 mesh. In other exemplary embodiments, the degradable particles should have an average particle size in the range of from about 100 mesh to about 40 mesh.

(Application at ¶ 0020.) A size of 400 mesh corresponds to 37 microns; a size of 8 mesh corresponds to 2.38 millimeters, or 2,380 microns. (*See* “Particle Size Conversion,” Sigma Aldrich Co., at http://www.sigmaaldrich.com/Area_of_Interest/Laboratory_Essentials/LabBasics/Key_Resources/Technical_Library/Particle_Size_Conversion.html.) Applicants have amended claims 1 and 62 to require that the average size of the degradable particles be from about 350 μm to about 2,380 μm . Similarly to the limitation of “between 35% and 60%” discussed in MPEP § 2163.05 and *In re Wertheim* above, a person skilled in the art would consider this range of average particle sizes to be inherently supported by at least the portion of Applicants’ disclosure quoted above.

Therefore, for at least these reasons, Applicants respectfully request the withdrawal of these § 112 rejections with respect to claims 1, 62, and all claims depending therefrom (*i.e.*, claims 2, 3, and 6-18).

B. Rejections of Claims Under 35 U.S.C. § 102(b)

1. Rejections of Claims Over U.S. Patent No. 4,575,396

Claims 1-3, 5, 14, and 60-62 stand rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 4,575,396 to Matsumoto *et al.* ("Matsumoto"). With respect to these rejections, the Final Office Action states:

Matsumoto teaches a method of wet blasting a surface with blasting media in order to clean the surface. In col. 3, lines 5-10, Matsumoto teaches blasting media comprising particles having a diameters of less than 0.5mm, which is equivalent to 500 microns. In col. 6, lines 20-25, Matsumoto teaches jetting the blasting media with water and compressed air against the object to be cleaned. In reference to claims 2-3, refer to col. 6, lines 20-25. In reference to claim 5, refer to col. 4, lines 27-29. In reference to claim 14, the limitations are inherently met since Matsumoto teaches a particle size of less than 500 microns. In reference to claims 61-62, refer to col. 4, lines 25-29 and col. 3, lines 3-5.

Applicant argues that the claims are not anticipated by Matsumoto. Specifically, applicant argues that Matsumoto teaches hard particles and fails to teach degradable particles. Applicant's arguments are unpersuasive because Matsumoto teaches the same particle composition as the instant specification. Specifically, paragraph 14 of the instant specification teaches that the particles can be polycarbonates and Matsumoto teaches particles made of polycarbonate.

(Final Office Action at ¶¶ 4 & 12.) The Advisory Action further states:

Applicant argues that Matsumoto fails to teach degradable particles. Applicant's arguments are unpersuasive because Matsumoto teaches the same particle composition as the instant specification. Specifically, paragraph 14 of the instant specification teaches that the particles can be polycarbonates and Matsumoto teaches particles made of polycarbonate. The burden is shifted on applicant to show that the polycarbonate of Matsumoto would not be degradable since both Matsumoto and the instant specification teaches the same composition.

(Advisory Action at Continuation to 11.) Applicants respectfully disagree with these rejections.

In order to form a basis for a rejection under 35 U.S.C. § 102(b), a prior art reference must disclose each and every element as set forth in the claim. MANUAL OF PATENT

EXAMINING PROCEDURE § 2131 (2005). Moreover, “[t]he identical invention must be shown in as complete detail [in the prior art reference] as is contained in the claim” in order to anticipate that claim. *Id.* (emphasis added). However, Applicants respectfully assert that *Matsumoto* does not disclose or teach allow a particle to degrade, nor does it disclose or teach particles that are degradable. Therefore, *Matsumoto* cannot anticipate Applicants’ claims.

The Final Office Action and Advisory Action indicate that *Matsumoto*’s disclosure of polycarbonates generally (*see Matsumoto* at col. 4, ll. 27-30) anticipates the degradable particles in Applicants’ claims based on Applicants’ disclosure that the degradable particles may comprise certain aliphatic polycarbonates. However, Applicants reiterate that the Final Office Action and Advisory Action state no “basis in fact and/or technical reasoning to reasonably support the determination that the [property of being degradable] necessarily flows from” *Matsumoto*’s teachings of polycarbonates generally. *Id.* at § 2112.02 (quoting *Ex parte Levy*, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) (emphasis in original)). Therefore, even though the degradable particles recited in Applicants’ claims may comprise certain polycarbonates (*e.g.*, aliphatic polycarbonates), *Matsumoto*’s generic teaching of polycarbonates does not automatically anticipate Applicants’ claims.

In fact, the polycarbonates taught in *Matsumoto* cannot be the same as those taught by Applicants’ specification because those polycarbonates are not degradable. *Matsumoto* teaches that, “[w]ith respect to blasting particles formed of polycarbonate, attention is directed to U.S. Pat. No. 3,313,067 which relates to a process for deflashing articles utilizing polycarbonate resin particles for blasting the formed parts or articles”. (*Matsumoto* at col. 2, ll. 55-59.) U.S. Patent No. 3,313,067 teaches the use of aromatic polycarbonates. *See* U.S. Patent No. 3,313,067 at col. 3, ll. 54-71. However, aromatic polycarbonates are known to be highly resistant to degradation. *See* BIODEGRADABLE POLYMERS FOR INDUSTRIAL APPLICATIONS 372 (Ray Smith ed., 2005) (copies of the cited pages from this text are enclosed for the Examiner’s convenience). Thus, *Matsumoto* does not teach or suggest the use of degradable particles as recited in Applicants’ claims.

Therefore, because *Matsumoto* does not disclose or teach allowing at least a portion of at least one of the degradable particles to degrade, or any particle that would be capable of doing so, Applicants respectfully assert that *Matsumoto* does not disclose each element of claims 1 and 60, as amended herein. Thus, *Matsumoto* cannot anticipate these claims,

and claims 1 and 60 are allowable over *Matsumoto*. Moreover, since “a claim in dependent form shall be construed to incorporate by reference all the limitations of the claim to which it refers,” and since claims 2, 3, 5, 14, 61, and 62 depend, either directly or indirectly, from independent claim 1 or 60, these dependent claims are allowable for at least the same reasons. *See* 35 U.S.C. § 112 ¶ 4 (2004). Accordingly, Applicants respectfully requests the withdrawal of these rejections.

2. Rejections of Claims Over U.S. Patent No. 5,865,902

Claims 1-3, 10-16, and 18 stand rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 5,865,902 to Yam *et al.* (“Yam”). With respect to these rejections, the Final Office Action states:

Yam *et al.* teach a method of cleaning electronic hardware by lasting with an abrasive media comprising a water soluble alkaline salt of bicarbonate and carbonate. Yam teaches particle sizes no larger than about 300 microns in diameter (Abstract). The limitations of greater than 300 microns reads on the teachings of Yam since “about 300 microns” can include values greater than 300 microns” (i.e. 301-303microns). In reference to claims 2-3, refer to col. 5, lines 10-13. In reference to claims 10-13, the limitations are met since Yam teaches a bicarbonate salt. In reference to claim 14, refer to col. 7, lines 28-47. In reference to claim 15, refer to col. 5, lines 30-35. In reference to claim 16, refer to coal. 5, lines 55-62. In reference to claim 18, refer to col. 5, lines 30-35.

Applicant argues that Yam teaches particle sizes not more than about 300 microns and fails to teach a particle size greater than about 300 microns. Applicant’s arguments are unpersuasive since no larger than about 300 microns reads on the teachings of Yam since “about 300 microns” can include values greater than 300 microns (i.e. 301-303 microns).

(Final Office Action at ¶¶ 5 & 13.) The Advisory Action maintains these rejections in view of the non-entry of the amendment in the April 7, 2006 Response. (Advisory Action at Continuation to 11.) Applicants respectfully disagree with these rejections.

In order to form a basis for a rejection under 35 U.S.C. § 102(b), a prior art reference must disclose each and every element as set forth in the claim. MANUAL OF PATENT EXAMINING PROCEDURE § 2131 (2005). In this response, Applicants have amended claim 1 to

recite that the degradable particles have an average particle size of from about 350 μm to about 2,380 μm . However, *Yam* does not disclose or teach particles of this size. Rather, *Yam* teaches the use of particles of alkaline salts that are “no larger than about 300 microns in diameter.” (*Yam* at Abstract.) Therefore, the particle sizes disclosed in *Yam* do not read on those recited in Applicants’ claims, and thus *Yam* cannot anticipate Applicants’ claims.

Because *Yam* cannot anticipate claim 1, as amended herein, this claim allowable over *Yam*. Moreover, since “a claim in dependent form shall be construed to incorporate by reference all the limitations of the claim to which it refers,” and since claims 2, 3, 10-16, and 18 depend, either directly or indirectly, from independent claim 1, these dependent claims are allowable for at least the same reasons. See 35 U.S.C. § 112 ¶ 4 (2004). Accordingly, Applicants respectfully requests the withdrawal of these rejections.

3. Rejections of Claims Over U.S. Patent No. 5,993,562

Claims 1-3 and 6-14 stand rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 5,993,562 to Roelofs *et al.* (“*Roelofs*”). With respect to these rejections, the Final Office Action states:

Roelofs teaches a method of cleaning the interior surfaces of a fluid delivery system by blasting with an abrasive particle in a liquid carrier. In col. 6, lines 1-65, Roelofs teaches particle sizes ranging from 5-500 microns. In reference to claims 2-3 refer to col. 6, lines 53-55. In reference to claims 6-7 and 10-13, refer to col. 6, lines 30-39 which teach abrasive particles comprising starch, boric acid, calcium borate, zinc borate, and sodium bicarbonate. In reference to claims 8-9, refer to co. 6, lines 53-67. In reference to claim 14, the limitations are inherently met since Roelofs teaches the claimed particle size.

Applicant argues that Roelofs ... fails to teach jetting against a surface to be cleaned. Applicant’s argues that the flow of the abraasive cleaner of Roelofs is not the same as “jetting”. Applicant’s arguments are unpersuasive. Jetting, as defined by Webster’s dictionary, means to emit a stream. Roelofs teaches circulating the abraasive cleaner at a predetermined flow rate in order to abrade the material that is to be removed from the fluid delivery system. The force of the abraasive cleaner as it is circulated through the interior surface of the fluid delivery system reads on the claimed limitation of jetting.

(Final Office Action at ¶¶ 6 & 14.) The Advisory Action maintains these rejections in view of the non-entry of the amendment in the April 7, 2006 Response. (Advisory Action at Continuation to 11.) Applicants respectfully disagree with these rejections.

In order to form a basis for a rejection under 35 U.S.C. § 102(b), a prior art reference must disclose each and every element as set forth in the claim. MANUAL OF PATENT EXAMINING PROCEDURE § 2131 (2005). In this response, Applicants have amended claim 1 to recite that the cleaning fluid is jetted at the surface to be cleaned at a jet pressure differential of above about 60 psi. However, *Roelofs* does not disclose or teach jetting a cleaning fluid at a jet pressure differential above about 60 psi. Rather, the teachings of flow rate in *Roelofs* only correspond to much lower jet pressure differentials:

Therefore, the method of the present invention can be and preferably is operated so that the flow of abrasive cleaner or abrasive-containing cleaner composition is under conditions that are similar to what the filter tube manufacturer suggests for circulating paint in ultrafilter systems. For example, ABCOR tubular filter units operate at about 35 to 40 gallons per minute (132 to 151 liters per minute) with an inlet pressure of 70 psi (483 kPa) and an outlet pressure of 10 psi (69 kPa). Another example is the commonly used 8-inch (20 centimeters) (cm) spiral "sanitary design" filter cartridge manufactured by AMT or OSMONICS that can be operated at about 60 to 70 gallons per minute (227 to 265 liters per minute) with 55 psi (379 kPa) inlet pressure and 25 psi (172 kPa) outlet pressure. Of course, the inlet and outlet pressures reflect the flow rate which can vary significantly from system to system.

(*Roelofs* at col. 5, ll. 44-59 (emphasis added).) The highest jet pressure differential (*i.e.*, difference between inlet pressure and outlet pressure) taught by *Roelofs* is the first of the two in the above quoted passage, which is equal to 60 psi. Therefore, the inlet/outlet pressures disclosed in *Roelofs* do not teach a jet pressure differential that is above about 60 psi, as recited in claim 1, as amended herein, and thus *Roelofs* cannot anticipate this claim.

Because *Roelofs* cannot anticipate claim 1, this claim allowable over *Roelofs*. Moreover, since "a claim in dependent form shall be construed to incorporate by reference all the limitations of the claim to which it refers," and since claims 2, 3, and 6-14 depend, either directly or indirectly, from independent claim 1, these dependent claims are allowable for at least the same reasons. See 35 U.S.C. § 112 ¶ 4 (2004). Accordingly, Applicants respectfully requests the withdrawal of these rejections.

C. Rejections of Claims Under 35 U.S.C. § 103(a)

Claim 17 stands rejected under 35 U.S.C. § 103(a) as unpatentable over *Roelofs* in view of European Patent Application Publication No. EP0510762 by Houghton *et al.* ("*Houghton*"). With respect to this rejection, the Final Office Action states:

Roelofs fails to teach the limitations of claim 17. Houghton teaches a cleaning composition comprising abrasive particles, such as perborate compounds. On page 8, lines 50-65, Houghton teaches that the cleaning compositions include conventional adjuvants such as corrosion inhibitors. It would have been obvious to a person of ordinary skill in the art to modify the methods of Roelofs to include adjuvants, such as corrosion inhibitors, as taught by Houghton, which are conventionally used in the cleaning compositions.

Applicant argues that ... Roelofs in combination with Houghton fails to teach jetting against a surface to be cleaned. Applicant's argues that the flow of the abraasive cleaner of Roelofs is not the same as "jetting". Applicant's arguments are unpersuasive. Jetting, as defined by Webster's dictionary, means to emit a stream. Roelofs teaches circulating the abraasive cleaner at a predetermined flow rate in order to abrade the material that is to be removed from the fluid delivery system. The force of the abraasive cleaner as it is circulated through the interior surface of the fluid delivery system reads on the claimed limitation of jetting.

(Final Office Action at ¶¶ 10 & 14.) The Advisory Action maintains this rejection in view of the non-entry of the amendment in the April 7, 2006 Response. (Advisory Action at Continuation to 11.) Applicants respectfully disagree with this rejection.

To form a basis for a § 103(a) rejection, a combination of prior art references must teach or suggest each element in the claim. MANUAL OF PATENT EXAMINING PROCEDURE § 2142 (2005). However, as discussed in Section III.B.3. above, *Roelofs* does not teach or suggest jetting a cleaning fluid at a surface to be cleaned at a jet pressure differential of above about 60 psi, as recited in claim 1, as amended herein. Nor does *Houghton* teach or suggest this limitation. Rather, *Houghton* only teaches certain types of cleaning fluids, and does not mention jetting a cleaning fluid at a surface at all, much less jetting at any particular jet pressure differential. Since claim 17 depends from claim 1, claim 17 also incorporates this limitation that neither *Roelofs* nor *Houghton* teaches or suggests. See 35 U.S.C. § 112 ¶ 4 (2004). Therefore,

since neither *Roelofs* nor *Houghton* teaches jetting a cleaning fluid at a jet pressure differential above about 60 psi, the combination of *Roelofs* and *Houghton* cannot obviate claim 17. Accordingly, Applicants respectfully request the withdrawal of this rejection.

SUMMARY

In light of the above remarks, Applicants respectfully request reconsideration and withdrawal of the outstanding rejections. Applicants further submit that the application is now in condition for allowance, and earnestly solicit timely notice of the same. Should the Examiner have any questions, comments or suggestions in furtherance of the prosecution of this application, the Examiner is invited to contact the attorney of record by telephone, facsimile, or electronic mail.

The Commissioner is hereby authorized to debit the Deposit Account of Halliburton Energy Services, Inc., No. 08-0300 in the amount of \$790.00 for the RCE fee of under 37 C.F.R. § 1.17(e). Should the Commissioner deem that any additional fees are due, including any fees for extensions of time, Applicants respectfully request that the Commissioner accept this as a Petition Therefor, and direct that any additional fees be charged to the Deposit Account of Halliburton Energy Services, Inc., No. 08-0300.

Respectfully submitted,



Robert A. Kent
Registration No. 28,626
Halliburton Energy Services, Inc.
2600 South Second Street
P.O. Drawer 1431
Duncan, OK 73536-0440
Telephone: 580-251-3125

Date: May 8, 2006



11W

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

SURJAATMADJA *ET AL.*

Serial No.: 10/783,207

Filed: FEBRUARY 20, 2004

Title: "METHODS OF CUTTING AND
CLEANING USING JETTED
FLUIDS"

§
§
§
§
§
§
§
§
§
§
§

Group Art Unit: 1764

Examiner: BIBI SHARIDAN CARRILLO

Atty. Docket No: HES 2003-IP-012367U1

MAIL STOP AF
Commissioner for Patents
P.O. Box 1450
Alexandria, Va 22313-1450

CERTIFICATE OF MAILING VIA EXPRESS MAIL	
ATTY. DOCKET No.:	HES 2003-IP-012367U1
SERIAL No.:	10/783,207
GROUP ART UNIT:	1764
EXAMINER:	BIBI SHARIDAN CARRILLO
PURSUANT TO 37 C.F.R. § 1.10, I HEREBY CERTIFY THAT I HAVE INFORMATION AND A REASONABLE BASIS FOR BELIEF THAT THIS CORRESPONDENCE WILL BE DEPOSITED WITH THE UNITED STATES POSTAL SERVICE AS EXPRESS MAIL, POST OFFICE TO ADDRESSEE, ON THE DATE INDICATED BELOW, AND IS ADDRESSED TO:	
MAIL STOP AMENDMENT COMMISSIONER FOR PATENTS P. O. Box 1450 ALEXANDRIA, VA 22313-1450.	
TAMMY KNIGHT	DATE 4/7/06
ED 80431918045	

**AMENDMENT AND RESPONSE UNDER 37 C.F.R. § 1.116 TO
FINAL OFFICE ACTION, MAILED FEBRUARY 9, 2006**

Sir:

In response to the Final Office Action mailed on February 9, 2006 (the "Final Office Action"), Applicants submit this response and respectfully requests reconsideration of the Examiner's rejections. Because this response has been filed within two months of when the Final Office Action was issued, Applicants respectfully request that the Examiner issue an

advisory action if the Examiner does not find the claims to be allowable in light of the amendments and remarks made herein.

In response to the Final Office Action, Applicants submit the following:

- **Amendments to the Claims**, which are reflected in the listing of claims that begins on page 3 of this paper; and
- **Remarks/Arguments**, which begin on page 7 of this paper.

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claims:

1. (Currently Amended) A method of cleaning a surface comprising: ~~the step of~~ jetting against a surface to be cleaned, a cleaning fluid comprising a liquid base fluid and degradable particles wherein the degradable particles act as an abrasive agent and wherein the degradable particles have an average particle size ~~greater than 300 μ m~~ of from about 350 μ m to about 2,380 μ m and wherein the cleaning fluid is jetted at the surface to be cleaned at a jet pressure differential of above about 60 psi; and
allowing at least a portion of at least one of the degradable particles to degrade.
2. (Original) The method of claim 1 wherein the base fluid comprises an aqueous fluid.
3. (Currently Amended) The method of claim 1 wherein the base fluid ~~comprises~~ is selected from the group consisting of fresh water, salt water, brine, seawater, ~~or a combination and combinations thereof.~~
4. (Cancelled)
5. (Currently Amended) The method of claim 1 wherein the degradable particle is a solid particle ~~comprising a polysaccharide; a chitin; a chitosan; a protein; an aliphatic polyester; a poly(lactide); a poly(glycolide); a poly(ϵ -caprolactone); a poly(hydroxybutyrate); a poly(anhydride); an aliphatic polycarbonate; a poly(orthoester); a poly(amino acid); a poly(ethylene oxide); a polyphosphazene; a polyvinyl alcohol; poly(adipic anhydride); poly(suberic anhydride); poly(sebacic anhydride); poly(dodecanedioic anhydride); poly(maleic anhydride); poly(benzoic anhydride); or a combination thereof~~ that comprises a material selected from the group consisting of polysaccharides, chitins, chitosans, proteins, aliphatic polyesters, poly(lactides), poly(glycolides), poly(ϵ -caprolactones), poly(hydroxybutyrates), poly(anhydrides), aliphatic polycarbonates, poly(orthoesters), poly(amino acids), poly(ethylene oxides), polyphosphazenes, polyvinyl alcohols, poly(adipic anhydrides), poly(suberic anhydrides), poly(sebacic anhydrides), poly(dodecanedioic anhydrides), poly(maleic anhydrides), poly(benzoic anhydrides), and combinations thereof.
6. (Original) The method of claim 1 wherein the degradable particle is a solid particle comprising a dehydrated salt.

7. (Currently Amended) The method of claim 1 wherein the degradable particle is a solid particle ~~comprising a solid anhydrous borate, anhydrous sodium tetraborate, anhydrous boric acid, or a combination thereof~~ that comprises a material selected from the group consisting of solid anhydrous borates, anhydrous sodium tetraborate, anhydrous boric acid, and combinations thereof.

8. (Original) The method of claim 1 wherein the base fluid comprises a nonaqueous fluid.

9. (Currently Amended) The method of claim 8 wherein the nonaqueous base fluid ~~comprises a mineral oil, a synthetic oil, an ester, or a combination thereof~~ is selected from the group consisting of mineral oils, synthetic oils, esters, and combinations thereof.

10. (Original) The method of claim 8 wherein the cleaning fluid further comprises a compound that will produce water upon degradation.

11. (Original) The method of claim 8 wherein the degradable particle further comprises a compound that will produce water upon degradation.

12. (Currently Amended) The method of claim 10 wherein the compound that will produce water upon degradation ~~comprises a hydrate of an organic acid; a hydrate of an organic acid salt; a hydrate of an inorganic acid; a hydrate of an inorganic acid salt; a starch-based polymer; a cellulose-based hydrophilic polymer; or a combination thereof~~ is selected from the group consisting of hydrates of organic acids, hydrates of organic acid salts, hydrates of inorganic acids, hydrates of inorganic acid salts, starch-based polymers, cellulose-based hydrophilic polymers, and combinations thereof.

13. (Currently Amended) The method of claim 11 wherein the compound that will produce water upon degradation ~~comprises a hydrate of an organic acid; a hydrate of an organic acid salt; a hydrate of an inorganic acid; a hydrate of an inorganic acid salt; a starch-based polymer; a cellulose-based hydrophilic polymer; or a combination thereof~~ is selected from the group consisting of hydrates of organic acids, hydrates of organic acid salts, hydrates of inorganic acids, hydrates of inorganic acid salts, starch-based polymers, cellulose-based hydrophilic polymers, and combinations thereof.

14. (Original) The method of claim 1 wherein the degradable particles have an average particle size of from about 400 mesh to about 8 mesh.

15. (Original) The method of claim 1 wherein the cleaning fluid is jetted at the surface to be cleaned at a jet pressure differential of below about 2,000 psi.

16. (Original) The method of claim 1 wherein the cleaning fluid is jetted at the surface to be cleaned at an angle from about 30 degrees to about 70 degrees relative to the surface to be cleaned.

17. (Currently Amended) The method of claim 1 wherein the cleaning fluid further comprises ~~a scale inhibitor, a chelating agent, a corrosion inhibitor, a clay stabilizer, or a combination thereof~~ an additive selected from the group consisting of scale inhibitors, chelating agents, corrosion inhibitors, clay stabilizers, and combinations thereof.

18. (Original) The method of claim 1 wherein the cleaning fluid comprises from about 0.1 to about 1 pound of degradable particles per gallon of base fluid.

19.- 59. (Cancelled)

60. (Currently Amended) A method of cleaning a surface comprising: ~~the step of~~ jetting against a surface to be cleaned, a cleaning fluid comprising a liquid base fluid and degradable particles wherein the degradable particles act as an abrasive agent and wherein the degradable particles comprise a degradable polymer; and allowing at least a portion of at least one of the degradable particles to degrade.

61. (Currently Amended) The method of claim 60 wherein the wherein the degradable polymer is a solid particle ~~comprising a polysaccharide; a chitin; a chitosan; a protein; an aliphatic polyester; a poly(lactide); a poly(glycolide); a poly(ϵ -caprolactone); a poly(hydroxybutyrate); a poly(anhydride); an aliphatic polycarbonate; a poly(orthoester); a poly(amino acid); a poly(ethylene oxide); a polyphosphazene; a polyvinyl alcohol; poly(adipic anhydride); poly(suberic anhydride); poly(sebacic anhydride); poly(dodecanedioic anhydride); poly(maleic anhydride); poly(benzoic anhydride); or a combination thereof~~ that comprises a material selected from the group consisting of polysaccharides, chitins, chitosans, proteins, aliphatic polyesters, poly(lactides), poly(glycolides), poly(ϵ -caprolactones), poly(hydroxybutyrates), poly(anhydrides), aliphatic polycarbonates, poly(orthoesters), poly(amino acids), poly(ethylene oxides), polyphosphazenes, polyvinyl alcohols, poly(adipic anhydrides), poly(suberic anhydrides), poly(sebacic anhydrides), poly(dodecanedioic anhydrides), poly(maleic anhydrides), poly(benzoic anhydrides), and combinations thereof.

62. (Currently Amended) The method of claim 60 wherein the degradable particles have an average particle size ~~greater than 300 μm~~ of from about 350 μm to about 2,380 μm .

REMARKS / ARGUMENTS

I. General Remarks

Please consider the application in view of the following remarks. Applicants thank the Examiner for his careful consideration of the application.

II. Disposition of Claims

Claims 1-3, 5-18, and 60-62 are pending in this application. Claims 4, 18, and 22 were cancelled previously. Claims 19-59 were cancelled previously in response to a restriction requirement.

In this Response, claims 1, 3, 5, 7, 9, 12, 13, 17, and 60-62 have been amended. These amendments are supported by the specification as filed.

Claims 1-3, 6-18, and 62 stand rejected under 35 U.S.C. § 112. Claims 1-3, 5-16, 18, and 60-62 stand rejected under 35 U.S.C. § 102(b). Claim 17 stands rejected under 35 U.S.C. § 103(a).

III. Rejections of Claims

A. Rejections of Claims Under 35 U.S.C. § 112

Claims 1-3, 6-18, and 62 stand rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention. (See Final Office Action at ¶ 2.) With respect to these rejections, the Final Office Action states that “[t]he limitations of a particle size greater than 300 microns is not supported by the specification and claims as originally filed and therefore constitute new matter.” *Id.* In response to Applicants’ remarks regarding these rejections in their previous response, the Final Office Action states:

Applicant [argues] that the specification has sufficient support for the limitations of a particle size greater than 300 microns. Applicant argues that to satisfy the written description requirement, a patent specification must describe the claimed invention in sufficient detail that one skilled in the art can reasonably conclude that the inventor has possession of the claimed invention. Applicant’s arguments are unpersuasive since it seems that applicant is arguing enablement and the rejection of the claims is based on a new matter rejection. Applicant also argues that since the instant specification teaches a particle size in the range of from about 400 mesh to about 8 mesh, the limitations of an average particle size greater than 300 microns is supported

by the specification. There is no recitation or suggestion in the original specification of the limitations of a particle size greater than 300 microns. Additionally, a particle size of greater than 300 microns could be outside the range of 400 mesh to about 8 mesh. A particle size of greater than 300 microns does not include the lower limit of 400 mesh, as exemplified in applicant's embodiment. The particle size of greater than 300 microns can include particle sizes that are greater than 8 mesh and therefore either limit of the range, including numbers between the range of 400 mesh to about 8 mesh would be excluded from applicant's claimed limitations of greater than 300 micron.

Additionally, [if] applicant is relying on the range of 400 mesh to about 8 mesh to support the particle size of greater than 300 microns, the range raises issues of nonenablement since greater than 300 microns includes values outside of the range of 400 mesh to about 8 mesh.

Id. at ¶ 11 (emphasis added). Applicants respectfully disagree.

In order to properly reject a claim under § 112, first paragraph, “[t]he examiner has the initial burden of presenting evidence or reasoning to explain why persons skilled in the art would not recognize in the original disclosure a description of the invention defined by the claims.” MANUAL OF PATENT EXAMINING PROCEDURE § 2163(II)(A)(3)(b) (2005). Merely arguing lack of explicit “recitation or suggestion” in the disclosure, as the Final Office Action states above, is not sufficient to satisfy the this burden. *See In re Wertheim*, 541 F.2d 257, 265 (CCPA 1976) (“The PTO has done nothing more than argue lack of literal support, which is not enough.”).

Rather, the determination of whether a claim limitation is sufficiently supported in the specification as filed (*i.e.*, whether the narrowing of a numerical range limitation constitutes the addition of new matter) “must take into account which ranges one skilled in the art would consider inherently supported by the discussion in the original disclosure.” MANUAL OF PATENT EXAMINING PROCEDURE § 2163.05 (2005) (discussing *In re Wertheim*, 541 F.2d 257, where a disclosed range of “25%-60%” range did not support a new limitation of “at least 35%,” but it did support a new limitation of “between 35% and 60%”); *see id.* at § 706.03(o) (discussing new matter rejections, and referring to *In re Wertheim* and MPEP § 2163.05 for determining whether addition of specific numerical ranges after a broader disclosure constitutes new matter). Applicants' specification as filed contains at least the following discussion of particle sizes:

The degradable particles generally should have a particle size that is suitable for use in jetting tools that may be used in the methods of the present invention. In an exemplary embodiment, the degradable particles should have an average particle size in the range of from about 400 mesh to about 8 mesh. In other exemplary embodiments, the degradable particles should have an average particle size in the range of from about 100 mesh to about 40 mesh.

(Application at ¶ 0020.) A size of 400 mesh corresponds to 37 microns; a size of 8 mesh corresponds to 2.38 millimeters, or 2,380 microns. (See "Particle Size Conversion," Sigma Aldrich Co., at http://www.sigmaaldrich.com/Area_of_Interest/Laboratory_Essentials/LabBasics/Key_Resources/Technical_Library/Particle_Size_Conversion.html.) Applicants have amended claims 1 and 62 to require that the average size of the degradable particles be from about 350 μm to about 2,380 μm . Similarly to the limitation of "between 35% and 60%" discussed in MPEP § 2163.05 and *In re Wertheim* above, a person skilled in the art would consider this range of average particle sizes to be inherently supported by at least the portion of Applicants' disclosure quoted above.

Therefore, for at least these reasons, Applicants respectfully request the withdrawal of these § 112 rejections with respect to claims 1, 62, and all claims depending therefrom (*i.e.*, claims 2, 3, and 6-18).

B. Rejections of Claims Under 35 U.S.C. § 102(b)

1. Rejections of Claims Over U.S. Patent No. 4,575,396

Claims 1-3, 5, 14, and 60-62 stand rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 4,575,396 to Matsumoto *et al.* ("*Matsumoto*"). With respect to these rejections, the Final Office Action states:

Matsumoto teaches a method of wet blasting a surface with blasting media in order to clean the surface. In col. 3, lines 5-10, Matsumoto teaches blasting media comprising particles having a diameters of less than 0.5mm, which is equivalent to 500 microns. In col. 6, lines 20-25, Matsumoto teaches jetting the blasting media with water and compressed air against the object to be cleaned. In reference to claims 2-3, refer to col. 6, lines 20-25. In reference to claim 5, refer to col. 4, lines 27-29. In reference to claim 14, the limitations are inherently met since Matsumoto teaches a particle size of less than 500 microns. In reference to claims 61-62, refer to col. 4, lines 25-29 and col. 3, lines 3-5.

Applicant argues that the claims are not anticipated by *Matsumoto*. Specifically, applicant argues that *Matsumoto* teaches hard particles and fails to teach degradable particles. Applicant's arguments are unpersuasive because *Matsumoto* teaches the same particle composition as the instant specification. Specifically, paragraph 14 of the instant specification teaches that the particles can be polycarbonates and *Matsumoto* teaches particles made of polycarbonate.

(Final Office Action at ¶¶ 4 & 12.) Applicants respectfully disagree with these rejections.

In order to form a basis for a rejection under 35 U.S.C. § 102(b), a prior art reference must disclose each and every element as set forth in the claim. MANUAL OF PATENT EXAMINING PROCEDURE § 2131 (2005). In this response, Applicants have amended claims 1 and 60 to recite allowing at least a portion of at least one of the degradable particles to degrade. Applicants respectfully assert that *Matsumoto* does not disclose or teach this step. Therefore, *Matsumoto* cannot anticipate Applicants' claims.

Matsumoto does disclose the use of "preferred resins" for forming masses that comprise "polycarbonate, polyacetyl, and polyester," and discloses that they "are normally available in both thermo-plastic and thermo-setting resins." (*Matsumoto* at col. 4, ll. 27-30.) However, *Matsumoto* does not disclose a method that includes allowing these materials, or any other materials, to at least partially degrade.

The Final Office Action implies that *Matsumoto*'s disclosure of polycarbonates generally teaches the use of degradable particles based on Applicants' disclosure that the degradable particles may comprise certain aliphatic polycarbonates. However, in order for a prior art reference's disclosure to anticipate a claim, "[t]he identical invention must be shown in as complete detail [in the prior art reference] as is contained in the claim." MANUAL OF PATENT EXAMINING PROCEDURE § 2131 (2005). *Matsumoto* fails to specifically disclose or teach polycarbonate particulates, or any other particulates, that are degradable as recited in Applicants' claims. Nor does the Final Office Action establish that the polycarbonates disclosed in *Matsumoto* would be inherently degradable since the Final Office Action states no "basis in fact and/or technical reasoning to reasonably support the determination that the [property of being degradable] necessarily flows from" *Matsumoto*'s teachings of polycarbonates generally. *Id.* at § 2112.02 (quoting *Ex parte Levy*, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990)

(emphasis in original)). Therefore, even though the degradable particulates recited in Applicants' claims may comprise certain polycarbonates (e.g., aliphatic polycarbonates), *Matsumoto*'s generic teaching of polycarbonates—which may or may not be degradable—does not anticipate Applicants' claims.

Therefore, because *Matsumoto* does not disclose or teach allowing at least a portion of at least one of the degradable particles to degrade, Applicants respectfully assert that *Matsumoto* does not disclose each element of claims 1 and 60, as amended herein. Thus, *Matsumoto* cannot anticipate these claims, and claims 1 and 60 are allowable over *Matsumoto*. Moreover, since “a claim in dependent form shall be construed to incorporate by reference all the limitations of the claim to which it refers,” and since claims 2, 3, 5, 14, 61, and 62 depend, either directly or indirectly, from independent claim 1 or 60, these dependent claims are allowable for at least the same reasons. See 35 U.S.C. § 112 ¶ 4 (2004). Accordingly, Applicants respectfully requests the withdrawal of these rejections.

2. Rejections of Claims Over U.S. Patent No. 5,865,902

Claims 1-3, 10-16, and 18 stand rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 5,865,902 to Yam *et al.* (“Yam”). With respect to these rejections, the Final Office Action states:

Yam et al. teach a method of cleaning electronic hardware by lasting with an abrasive media comprising a water soluble alkaline salt of bicarbonate and carbonate. Yam teaches particle sizes no larger than about 300 microns in diameter (Abstract). The limitations of greater than 300 microns reads on the teachings of Yam since “about 300 microns” can include values greater than 300 microns” (i.e. 301-303microns). In reference to claims 2-3, refer to col. 5, lines 10-13. In reference to claims 10-13, the limitations are met since Yam teaches a bicarbonate salt. In reference to claim 14, refer to col. 7, lines 28-47. In reference to claim 15, refer to col. 5, lines 30-35. In reference to claim 16, refer to coal. 5, lines 55-62. In reference to claim 18, refer to col. 5, lines 30-35.

Applicant argues that Yam teaches particle sizes not more than about 300 microns and fails to teach a particle size greater than about 300 microns. Applicant's arguments are unpersuasive since no larger than about 300 microns reads on the teachings of Yam

since “about 300 microns” can include values greater than 300 microns (i.e. 301-303 microns).

(Final Office Action at ¶¶ 5 & 13.) Applicants respectfully disagree with these rejections.

In order to form a basis for a rejection under 35 U.S.C. § 102(b), a prior art reference must disclose each and every element as set forth in the claim. MANUAL OF PATENT EXAMINING PROCEDURE § 2131 (2005). In this response, Applicants have amended claim 1 to recite that the degradable particles have an average particle size of from about 350 µm to about 2,380 µm. However, *Yam* does not disclose or teach particles of this size. Rather, *Yam* teaches the use of particles of alkaline salts that are “no larger than about 300 microns in diameter.” (*Yam* at Abstract.) Therefore, the particle sizes disclosed in *Yam* do not read on those recited in Applicants’ claims, and thus *Yam* cannot anticipate Applicants’ claims.

Because *Yam* cannot anticipate claim 1, as amended herein, this claim allowable over *Yam*. Moreover, since “a claim in dependent form shall be construed to incorporate by reference all the limitations of the claim to which it refers,” and since claims 2, 3, 10-16, and 18 depend, either directly or indirectly, from independent claim 1, these dependent claims are allowable for at least the same reasons. See 35 U.S.C. § 112 ¶4 (2004). Accordingly, Applicants respectfully requests the withdrawal of these rejections.

3. Rejections of Claims Over U.S. Patent No. 5,993,562

Claims 1-3 and 6-14 stand rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 5,993,562 to Roelofs *et al.* (“*Roelofs*”). With respect to these rejections, the Final Office Action states:

Roelofs teaches a method of cleaning the interior surfaces of a fluid delivery system by blasting with an abrasive particle in a liquid carrier. In col. 6, lines 1-65, Roelofs teaches particle sizes ranging from 5-500 microns. In reference to claims 2-3 refer to col. 6, lines 53-55. In reference to claims 6-7 and 10-13, refer to col. 6, lines 30-39 which teach abrasive particles comprising starch, boric acid, calcium borate, zinc borate, and sodium bicarbonate. In reference to claims 8-9, refer to co. 6, lines 53-67. In reference to claim 14, the limitations are inherently met since Roelofs teaches the claimed particle size.

Applicant argues that Roelofs ... fails to teach jetting against a surface to be cleaned. Applicant’s argues that the flow of the

abrasive cleaner of Roelofs is not the same as "jetting". Applicant's arguments are unpersuasive. Jetting, as defined by Webster's dictionary, means to emit a stream. Roelofs teaches circulating the abrasive cleaner at a predetermined flow rate in order to abrade the material that is to be removed from the fluid delivery system. The force of the abrasive cleaner as it is circulated through the interior surface of the fluid delivery system reads on the claimed limitation of jetting.

(Final Office Action at ¶¶ 6 & 14.) Applicants respectfully disagree with these rejections.

In order to form a basis for a rejection under 35 U.S.C. § 102(b), a prior art reference must disclose each and every element as set forth in the claim. MANUAL OF PATENT EXAMINING PROCEDURE § 2131 (2005). In this response, Applicants have amended claim 1 to recite that the cleaning fluid is jetted at the surface to be cleaned at a jet pressure differential of above about 60 psi. However, *Roelofs* does not disclose or teach jetting a cleaning fluid at a jet pressure differential above about 60 psi. Rather, the teachings of flow rate in *Roelofs* only correspond to much lower jet pressure differentials:

Therefore, the method of the present invention can be and preferably is operated so that the flow of abrasive cleaner or abrasive-containing cleaner composition is under conditions that are similar to what the filter tube manufacturer suggests for circulating paint in ultrafilter systems. For example, ABCOR tubular filter units operate at about 35 to 40 gallons per minute (132 to 151 liters per minute) with an inlet pressure of 70 psi (483 kPa) and an outlet pressure of 10 psi (69 kPa). Another example is the commonly used 8-inch (20 centimeters) (cm) spiral "sanitary design" filter cartridge manufactured by AMT or OSMONICS that can be operated at about 60 to 70 gallons per minute (227 to 265 liters per minute) with 55 psi (379 kPa) inlet pressure and 25 psi (172 kPa) outlet pressure. Of course, the inlet and outlet pressures reflect the flow rate which can vary significantly from system to system.

(*Roelofs* at col. 5, ll. 44-59 (emphasis added).) The highest jet pressure differential (*i.e.*, difference between inlet pressure and outlet pressure) taught by *Roelofs* is the first of the two in the above quoted passage, which is equal to 60 psi. Therefore, the inlet/outlet pressures disclosed in *Roelofs* do not teach a jet pressure differential that is above about 60 psi, as recited in claim 1, as amended herein, and thus *Roelofs* cannot anticipate this claim.

Because *Roelofs* cannot anticipate claim 1, this claim allowable over *Roelofs*. Moreover, since "a claim in dependent form shall be construed to incorporate by reference all the

limitations of the claim to which it refers,” and since claims 2, 3, and 6-14 depend, either directly or indirectly, from independent claim 1, these dependent claims are allowable for at least the same reasons. *See* 35 U.S.C. § 112 ¶ 4 (2004). Accordingly, Applicants respectfully requests the withdrawal of these rejections.

C. Rejections of Claims Under 35 U.S.C. § 103(a)

Claim 17 stands rejected under 35 U.S.C. § 103(a) as unpatentable over *Roelofs* in view of European Patent Application Publication No. EP0510762 by Houghton *et al.* (“*Houghton*”). With respect to this rejection, the Final Office Action states:

Roelofs fails to teach the limitations of claim 17. Houghton teaches a cleaning composition comprising abrasive particles, such as perborate compounds. On page 8, lines 50-65, Houghton teaches that the cleaning compositions include conventional adjuvants such as corrosion inhibitors. It would have been obvious to a person of ordinary skill in the art to modify the methods of Roelofs to include adjuvants, such as corrosion inhibitors, as taught by Houghton, which are conventionally used in the cleaning compositions.

Applicant argues that ... Roelofs in combination with Houghton fails to teach jetting against a surface to be cleaned. Applicant’s argues that the flow of the abraasive cleaner of Roelofs is not the same as “jetting”. Applicant’s arguments are unpersuasive. Jetting, as defined by Webster’s dictionary, means to emit a stream. Roelofs teaches circulating the abraasive cleaner at a predetermined flow rate in order to abrade the material that is to be removed from the fluid delivery system. The force of the abraasive cleaner as it is circulated through the interior surface of the fluid delivery system reads on the claimed limitation of jetting.

(Final Office Action at ¶¶ 10 & 14.) Applicants respectfully disagree with these rejections.

To form a basis for a § 103(a) rejection, a combination of prior art references must teach or suggest each element in the claim. MANUAL OF PATENT EXAMINING PROCEDURE § 2142 (2005). However, as discussed in Section III.B.3. above, *Roelofs* does not teach or suggest jetting a cleaning fluid at a surface to be cleaned at a jet pressure differential of above about 60 psi, as recited in claim 1, as amended herein. Nor does *Houghton* teach or suggest this limitation. Rather, *Houghton* only teaches certain types of cleaning fluids, and does not mention jetting a cleaning fluid at a surface at all, much less jetting at any particular jet pressure

differential. Since claim 17 depends from claim 1, claim 17 also incorporates this limitation that neither *Roelofs* nor *Houghton* teaches or suggests. See 35 U.S.C. § 112 ¶ 4 (2004). Therefore, since neither *Roelofs* nor *Houghton* teaches jetting a cleaning fluid at a jet pressure differential above about 60 psi, the combination of *Roelofs* and *Houghton* cannot obviate claim 17. Accordingly, Applicants respectfully request the withdrawal of this rejection.

SUMMARY

In light of the above remarks, Applicants respectfully request reconsideration and withdrawal of the outstanding rejections. Applicants further submit that the application is now in condition for allowance, and earnestly solicit timely notice of the same. Because this response has been filed within two months of when the Final Office Action was issued, Applicants respectfully request that the Examiner issue an advisory action if the Examiner does not find the claims to be allowable in light of the amendments and remarks made herein. Should the Examiner have any questions, comments or suggestions in furtherance of the prosecution of this application, the Examiner is invited to contact the attorney of record by telephone, facsimile, or electronic mail.

Applicants believe that there are no fees due in association with this filing of this Response. However, should the Commissioner deem that any additional fees are due, including any fees for extensions of time, Applicants respectfully request that the Commissioner accept this as a Petition Therefor, and direct that any additional fees be charged to the Deposit Account of Halliburton Energy Services, Inc., No. 08-0300.

Respectfully submitted,



Robert A. Kent
Registration No. 28,626
Halliburton Energy Services, Inc.
2600 South Second Street
P.O. Drawer 1431
Duncan, OK 73536-0440
Telephone: 580-251-3125

Date: April 7, 2006



Biodegradable polymers for industrial applications

Edited by
Ray Smith

TP

1180

.1355

1356

2005



CRC Press
Boca Raton Boston New York Washington, DC

WOODHEAD PUBLISHING LIMITED
Cambridge England

Published by Woodhead Publishing Limited
Abington Hall, Abington
Cambridge CB1 6AH
England

www.woodheadpublishing.com

Published in North America by CRC Press LLC
2000 Corporate Blvd, NW
Boca Raton FL 33431
USA

First published 2005, Woodhead Publishing Limited and CRC Press LLC
© 2005, Woodhead Publishing Limited

The authors have asserted their moral rights.

This book contains information obtained from authentic and highly regarded sources. Reprinted material is quoted with permission, and sources are indicated. Reasonable efforts have been made to publish reliable data and information, but the authors and the publishers cannot assume responsibility for the validity of all materials. Neither the authors nor the publishers, nor anyone else associated with this publication, shall be liable for any loss, damage or liability directly or indirectly caused or alleged to be caused by this book.

Neither this book nor any part may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, microfilming and recording, or by any information storage or retrieval system, without permission in writing from the publishers.

The consent of Woodhead Publishing Limited and CRC Press LLC does not extend to copying for general distribution, for promotion, for creating new works, or for resale. Specific permission must be obtained in writing from Woodhead Publishing Limited or CRC Press LLC for such copying.

Trademark notice: product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation, without intent to infringe.

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library.

Library of Congress Cataloging-in-Publication Data

A catalog record for this book is available from the Library of Congress:

Woodhead Publishing Limited ISBN 1 85573 934 8

CRC Press ISBN 0-8493-3466-7

CRC Press order number: WP3466

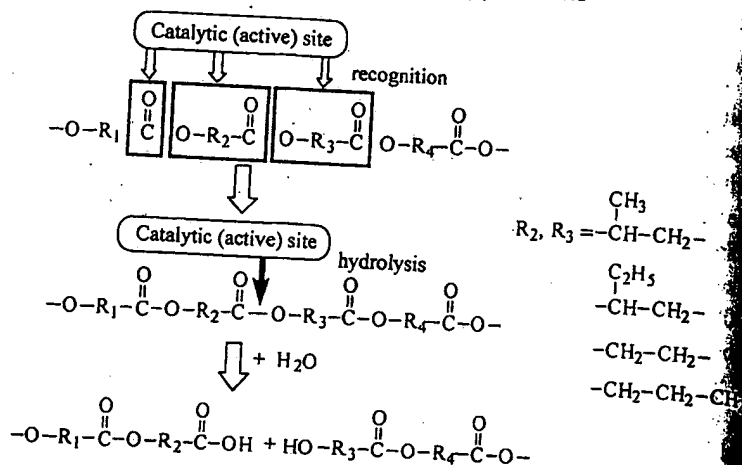
The publishers' policy is to use permanent paper from mills that operate a sustainable forestry policy, and which has been manufactured from pulp which is processed using acid-free and elementary chlorine-free practices. Furthermore, the publishers ensure that the text paper and cover board used have met acceptable environmental accreditation standards.

Project managed by Macfarlane Production Services, Markyate, Hertfordshire
(macfarl@aol.com)

Typeset by Godiva Publishing Services Ltd, Coventry, West Midlands

Printed by TJ International Limited, Padstow, Cornwall, England

BEST AVAILABLE COPY

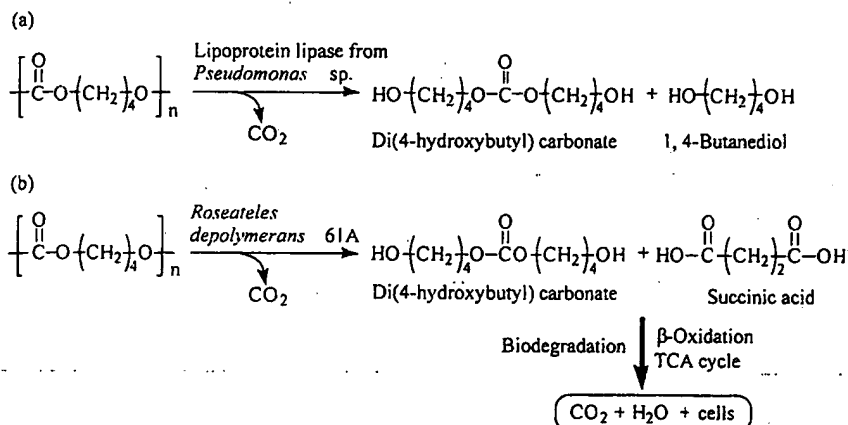


14.10 A schematic model for the enzymatic hydrolysis of an ester bond in various sequences by PHB depolymerase (adapted from Abe, *et al.*, 1995).

14.5 Biodegradation mechanism of polycarbonates and polyethers

14.5.1 Polycarbonates

Bisphenol A-derived aromatic polycarbonates are widely used as long-term commodity plastics in many fields; however, they are highly resistant to biodegradation. On the other hand, aliphatic polycarbonates can be expected to be biodegradable and biocompatible plastics, especially for medical applications. The biodegradation of aliphatic polycarbonates has been studied and many microbial strains capable of biodegrading aliphatic polycarbonates were isolated (Pranamuda *et al.*, 1999). Also, *Roseateles depolymerans* strain 61A was isolated as a poly(hexamethylene carbonate) degrader (Suyama *et al.*, 1999). Poly(tetramethylene carbonate) was degraded by lipoprotein lipase from *Pseudomonas* sp. first forming tetramethylene carbonate oligomers. The oligomers were further degraded into small units consisting of di(4-hydroxybutyl)carbonate and 1,4-butanediol as shown in Fig. 14.11a (Suyama and Tokiwa, 1997). With the microbial degradation of polycarbonate, the evolution of carbon dioxide and the oxidation of diol to the diacid occur simultaneously. That is, *Roseateles depolymerans* strain 61A was shown to form di(6-hydroxyhexyl)carbonate and adipic acid from poly(6-hydroxyhexyl carbonate) and di(4-hydroxybutyl)carbonate and succinic acid from poly(4-hydroxybutyl carbonate). Transiently accumulated intermediates will be further assimilated by the environmental microbes to produce carbon dioxide and microbial cells as the ultimate biodegradation (Fig. 14.11b) (Tokiwa, 2003a). The biodegradabilities of various copolyester-carbonates have been reported. Above all, copolycarbonates containing the lactide moiety have been extensively



14.11 Enzymatic degradation of polycarbonate.

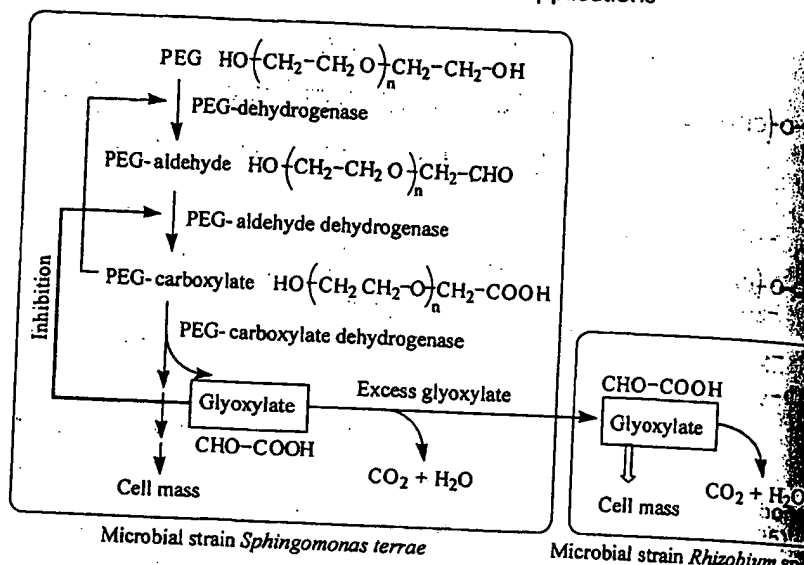
studied with respect to biodegradation and enzymatic degradation. (Matsumura *et al.*, 1999a; Liu *et al.*, 2003; Tsutsumi *et al.*, 2002, 2003a,b; Pego *et al.*, 2003a,b; Kim and Lee, 2002a,b). Copolycarbonates containing the urethane moiety have also been studied with respect to biodegradation and enzymatic degradation (Tang *et al.*, 2002, 2003a,b; Matheson *et al.*, 2002). Furthermore, biodegradable triblock copolycarbonates have been reported. (Zhou *et al.*, 2004).

The *in vivo* degradation of polycarbonates and copolymers has been reported. The *in vivo* behavior of poly(1,3-trimethylene carbonate) and the copolymers of 1,3-trimethylene carbonate with DL-lactide or ϵ -caprolactone were reported by Pego *et al.* (2003a,b), Christenson *et al.* (2004a,b) and Matheson *et al.* (2002).

14.5.2 Poly(ethylene glycol) (PEG)

Poly(alkylene glycol)s are widely used as raw materials for the synthesis of detergents and polyurethanes. They are either water-soluble or oily liquids and generally they cannot be recycled or recovered. Therefore, a ready biodegradability will be essential. Among the poly(alkylene glycol)s, poly(ethylene glycol) (PEG) is manufactured in large quantities as a commodity chemical in various fields.

The biodegradation of polyethers has been investigated since 1962, especially PEG (Fincher and Payne, 1962). They isolated some aerobic PEG-utilizing bacteria which assimilated PEGs with a variety of molecular weights up to 400. Since then, many reports have been published on aerobic PEG-assimilating bacteria (Ogata *et al.*, 1975; Hosoya *et al.*, 1978; Kawai, 1995, 2002). Various commonly occurring bacteria assimilated low-molecular weight PEGs up to molecular weights of 4,000, while higher molecular weight PEGs from 4,000 to 20,000 were assimilated by a limited number of species: *Pseudomonas aeruginosa* (up to 20,000); (Haines and Alexander, 1975); *Pseudomonas*

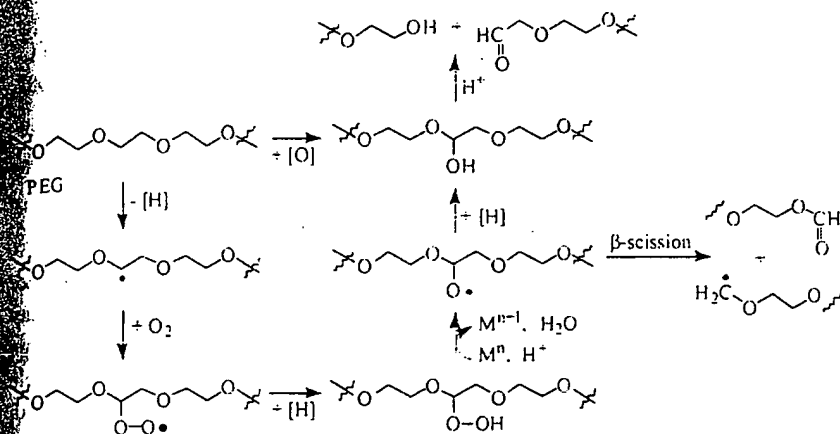


14.12 Mechanism of symbiotic degradation of PEG (adapted from Kawai and Yamanaka, 1986).

stutzeri (up to 13,500); (Obradors and Aguilar, 1991) and *Spingomonas* species (up to 2,000); (Takeuchi *et al.*, 1993; Kawai and Takeuchi, 1996). For the degradation, a symbiotic culture played an important role. The mechanism of the symbiotic biodegradation of PEG by *Spingomonas terrae* and *Rhizobium* sp. was elucidated as being due to the removal of a toxic metabolite, glyoxylate, which is formed during the biodegradation process as shown in Fig. 14.12 (Kawai and Yamanaka, 1986).

The PEG degradation pathway under aerobic conditions described by Kawai is described as follows: the first stage is a dehydrogenation (an aldehyde dehydrogenase); the second stage is an oxidation (an aldehyde dehydrogenase oxidase); and the third stage is an oxidation followed by hydrolysis to liberate a two-carbon fragment as glyoxylic acid. That is, PEG is successively oxidized to an aldehyde and a monocarboxylic acid, and this is followed by the cleavage of the ether bond, resulting in PEG molecules that are shortened by one glycol unit. Simultaneous oxidation of the two-terminal hydroxyl group of PEG is also possible. The glyoxylic acid produced may be metabolized by known pathways such as the oxidative dicarboxylic acid cycle, TCA cycle and the glyoxylate pathway. The biodegradation exogenously proceeds from a terminal hydroxyl group of PEG and thus strictly depends on the terminal groups of PEG (Kawai, 1992, 1993). The monoalkyl PEG was biodegraded, but not the dialkyl PEG. Anaerobic biodegradation of PEG was also demonstrated (Schink and Stahl, 1983). Dwyer and Tiedje (1983) obtained methanogenic consortia from sewage sludge, which can degrade PEG with a molecular weight up to 20,000.

BEST AVAILABLE COPY

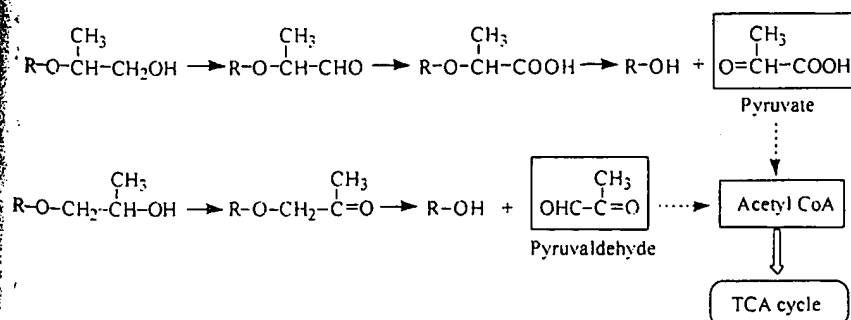


14.13 Predicted pathways of PEO scission by oxygen insertion or hydrogen abstraction (adapted from Kerem *et al.*, 1998).

Apart from these dehydrogenation mechanisms, a radical oxidative cleavage at the ether linkages was reported. Biodegradation of PEG by brown-rot fungi, *Gloeophyllum trabeum* occurred by depolymerization due to the oxidative C-C bond cleavage at random locations. The predicted pathways of the PEG scission of PEG after oxygen insertion or hydrogen abstraction are shown in Fig. 14.13 (Kerem *et al.*, 1998).

14.5.3 Poly(propylene glycol)

The susceptibility of polypropylene glycol to biological degradation has only a limited characterization. The strain *Stenotrophomonas maltophilia* grew on various PPGs with a number-average molecular weight of up to 4,000 but did not assimilate the PEGs (Tachibana *et al.*, 2002). The degradation mechanism of PPG is possibly similar to that of PEG; oxidation of the terminal OH group must



14.14 Proposed mechanisms of PPG degradation (adapted from Kawai, 1993).